

PLASMA FRUCTOSE AND CHOLESTEROL LEVELS IN DIABETESNWABUEZE, E.U¹, NWABUEZE, N.O²

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ABSTRACT

The main purpose of this work is to assess the different levels of fructose and cholesterol in diabetics and normal subjects, and to see if fructose can serve as substitute for glucose in diabetics. Fasting blood samples (12 hour fasting blood samples) were used to determine the different levels of plasma glucose, fructose and cholesterol in diabetic patients their mean concentration are as follows; total cholesterol is $(337.17 \pm 48.72\text{mg/dl})$, plasma fructose $(1.06 \pm 0.06\text{mg/dl})$, plasma glucose $(294.13 \pm 66.73\text{mg/dl})$. Also plasma glucose, fructose and cholesterol levels were determined using fasting blood samples from individuals who are apparently normal and their mean values read as follows; Total cholesterol $(154.55- 27.09\text{mg/dl})$, plasma fructose $(1,03 \pm 0.09\text{mg/dl})$, plasma glucose $(74.35 \pm 9.36\text{mg/dl})$. The result of the assay revealed a high level of cholesterol in diabetic patients and the

Introduction:

Diabetes mellitus has been a chronic disease due to deficiency or diminished effectiveness of insulin - a hormone capable of converting glucose into the energy needed by the body cells, to sustain daily living. Its hallmark is high level of unabsorbable glucose in the blood and urine. This situation exposes the patient to high risk of serious health complications which includes stroke, kidney failure, blindness, impaired sexual response, nerve damage, hypertension, severe infection leading to gangrene, foot and leg amputation and hypercholesterolemia

mean value $537.17 \pm 48.7\text{mg/dl}$) was significantly increased ($p < 0.05$) when compared with the reading $154.05 \pm 27.9\text{mg/dl}$) for normal subjects. Also the mean value for plasma fructose ($1.06 \pm 06\text{mg/dl}$) were not significantly different, ($P > 0.05$) when compared with the values ($1.03-0.09\text{mg/dl}$) for normal. There is raised level of plasma glucose in diabetics and the mean value ($294.01 \pm 66.07\text{mg/dl}$) differed significantly ($p < 0.05$) when compared with the reading $4.3 \pm 9.03\text{mg/dl}$) for normal subjects. The mean value ($193 \pm 20.0\text{mg/dl}$) for total cholesterol in diabetic males showed a significant difference ($p < 0.05$) when compared with ($144.02 \pm 17.00\text{mg/dl}$) for diabetic females. A good correlation exists between plasma glucose and cholesterol ($r = 0.82$, $df = 65$, $p < 0.001$). While there is no correlation between plasma fructose and cholesterol ($r = -0.069$, $df = 65$, $p > 0.05$).

Keywords: Plasma, Fructose, Cholesterol, Levels, Diabetes.

Introduction

With coronary artery disease, atherosclerosis and myocardial infarction.

In Nigeria, it is estimated that there are about 1-2 million cases of diabetes mellitus (Basket, 1991). About 5.5 percent of adults aged 45 years and above are estimated to be suffering from the disease. There are also many unidentified cases of the disease in the population. Unless they are identified quite early, brought into good medical care and taught diabetes self management skills, life expectancy for them and for the nation will continue to be low.

Morbidity and mortality rates among cases are higher than in non-cases. Because of the frequency and scope of medical intervention for the disease, and associated conditions, it is a very expensive disease to manage. The prevalence of the disease in the society irrespective of age and sex and its deadly complications has attracted my interest to evaluate the level of fructose and cholesterol in diabetics and apparently normal subjects.

The estimated plasma cholesterol concentration varies with the specificity of the method. An acceptable table normal range for adult is 140-

240(mg/dl), varying with the population sampled, and increasing with advancing age, until the age of 50years, being higher in men. There is a wealth of epidemiological and experimental evidence, indicating that diet high in saturated fatty acid is associated with high level of plasma cholesterol which in turn are related to incidence of . cardiovascular disease(bright and Southgate, 1991),

An acceptable normal range for plasma fructose is 0.6 - 1.6(mg/dt). Since the reaction involved in the absorption and phosphorylation of fructose can occur at a normal rate in the absence of insulin, fructose can be recommended to diabetic patients to replete their carbohydrate stores.

Aims and Objectives

- To assess the different level of fructose and cholesterol in normal and diabetic patient.
- To compare the level of fructose in diabetics and normal subjects.
- To compare the level of glucose in diabetics and normal subjects.
- To compare the level of cholesterol in diabetics and normal subjects.
- To compare the level of fructose and cholesterol in diabetic and normal males and females.

Methodology and Materials

5ml of fasting blood samples were collected from patients with clinical impression of diabetes mellilus within the age range of 45 - 75 years, attending Ikenegbu hospital and Chapel Group all in Owerri Imo State and Osina Specialist Hospital Ideato.

A few individuals volunteered to be used as control, they were tested and confirmed to be normal. The blood samples were collected in fluoride bottles, centrifuged at 2000rpm).

Methodology for total cholesterol (Friewald et al 1972)

Procedure:

1. Into three long test tubes, 0.1m of sample, standard and blank was added.
2. Also 3mol of ferric chloride was added to all the tubes.

3. The content of the tubes were spun and 2ml of the supernatants were collected.
4. To all the tubes, 1mol of con H₂SO₄ was added

Calculation

$$\text{cholesterol (mg/dl)} \frac{\text{absorbance of test}}{\text{absorbance of std}} = \text{con of std}$$

Methodology for plasma fructose (Ojiako etal, 1997)

Procedure

1. Into long test tubes 0.2ml of sample, 0.3mol of H₂SO₄ and 0.2ml of 15% sodium turgstate were added.
2. The tube was spur for 5mins.
3. Also three sets of test tube were labelled standard blank and test
4. To all the respective tubes 10ml of supernatant was added.
5. Also 0.2ml of indole -3 acetic acid and 8ml of conc Hcl were added to all the tubes and incubated for 5mins

Calculation

$$\text{fructose (mg/dl)} \frac{\text{absorbance of test}}{\text{absorbance of std}} = \text{con of std}$$

Methodology for plasma glucose

Procedure

1. Three long test tubes set up labeled test, std, and blank
2. Into the tubes 5ml of blood was added to 2.9ml protein precipitant and spun for 5mins.
3. Also 1ml of the supernatant were transferred to 3 new set of test tubes.

A 3ml of colour reagent was added to all the tubes.

Calculation

$$\text{Blood glucose (mg/dl)} \frac{\text{absorbance of test}}{\text{absorbance of std}} = \text{con std}$$

Results

Table1: shows plasma glucose, fructose and cholesterol levels in normal and diabetic patients (mean \pm standard dev)

	Diabetics	Normal
Plasma glucose (mg/dl)	294.1 \pm 66.7	74.3 \pm 9.3
Plasma fructose (mg/dl)	1.06 \pm 0.06	1.3 \pm 0.09
Plasma cholesterol (mg/dl)	337 \pm 48.7	154.5 \pm 27.9

Table 2: shows plasma glucose, fructose and cholesterol levels in male and female diabetic patients (mean \pm standard dev)

	Diabetics		Normal	
Plasma glucose (mg/dl)	297.1 \pm 51.3	272.6 \pm 50.6	74.3 \pm 9.3	72 \pm 10.6
Plasma fructose (mg/dl)	1.03 \pm 0.06	1.07 \pm 0.07	1.3 \pm 0.09	1.27 \pm 0.07
Plasma cholesterol (mg/dl)	356 \pm 42.3	284 \pm 28.1	154.5 \pm 27.9	144.2 \pm 17.0

Table;1 shows the mean values for plasma glucose, fructose and cholesterol levels for a total of 36 patients who are diabetic. It also shows the mean values of another set of 31 subjects that are normal. In the analysis of the results, the student's t-test was used to compare the mean value for plasma glucose, fructose and cholesterol levels and normal subjects and diabetic patients.

Table;2 also shows that the reading (294.01 \pm 66.0/mg/dl) for plasma glucose in diabetics differed significantly ($p < 0,05$) from (74.03 \pm 9.03mg/dl) for normal subjects. The mean concentration (1.06 \pm 0.06mg/dl) for plasma fructose in diabetics were not significantly different ($P > 0.05$) when compared with the reading (154,5 \pm 27.09mg/dl) for normal subject. Also the mean value (337.01 \pm 48 .07m//dl) for plasma cholesterol in diabetic patient were significantly increased ($p < 0.05$)

when compared with the reading of $(1.54.05 \pm 27.09\text{mg/dl})$ for normal subject.

The mean concentration $(297 \pm 51.03\text{mg/dl})$ and $(1.03 \pm 0.06\text{mg/dl})$ for plasma glucose and fructose respectively for diabetic males were not significantly different when compared with the mean values $(272 \pm 45.06\text{mg/dl})$, $(1.07 \pm 0.07\text{mg/dl})$ for diabetic females. While the mean value $(356 \pm 42.03\text{mg/dl})$ for plasma cholesterol in diabetic males showed a significant increase ($P < 0,05$) when compared with the mean value $(284 \pm 28.01\text{mg/dl})$ for diabetic females

Discussion

The investigation has shown that there is significantly elevated plasma glucose level in diabetics than normal subjects when compared using the student's t-test. This observation is in conformity with those of baron (1980) who stated that one of the metabolic features of diabetes mellitus is hyperglycaemia. If the plasma glucose concentration is greater than 7.8 mmol/L and the renal function is normal, there will be glycosuria as well as polyuria. Cerebral-cellular dehydration due to hyperosmolarity, secondary to hyperglycaemia causes thirst.

Secondly, the plasma fructose level in diabetics were not however, significantly different from those of normals when compared using the students t-test. This is substantiated by (Ganong, 1975), who showed that since the reactions involved in the absorption and phosphorylation of fructose can occur at a normal rate in the absence of insulin. That fructose can be recommended to diabetics to replete their carbohydrate stores however, because appreciable quantities of fructose are metabolized only in the liver and the intestine, fructose treatment is of limited value.

Thirdly, the investigation also revealed that there is significantly elevated level of total cholesterol in diabetics when compared with apparently normal subjects. This point is consistent with those of Philip (1994) who showed that because of the abnormalities in lipid metabolism, diabetes mellitus is often a contributory factors to elevated plasma cholesterol of hypercholesterolemia). When the plasma concentration is high, some may enter cells by passive unregulated routes. Because of the small size of low

density lipoprotein (LDL), particles can infiltrate tissues such as those of the arterial walls and cause damage. This is directly or indirectly associated with atherosclerosis coronary artery disease and myocardial infarction. Fourthly, this investigation also revealed a slightly significant increase in plasma cholesterol levels in diabetic males when compared with diabetic females. Glutton (1980) stated that hormones has a role to play in plasma cholesterol levels. He noted that increase in males is as a result of male sex hormones androgen, which increases the level of lipids especially cholesterol in the body.

Conclusion

One of the major findings in this study is that there is raised level of cholesterol in diabetic patients, and this is directly or indirectly associated with coronary artery diseases, atherosclerosis and myocardial infarction. Therefore, the elevated level of cholesterol can be regulated by taking less of diet high in saturated fatty acids.

The study also revealed a normal level of plasma fructose in diabetics and normal subjects. This substantiates the fact that absorption and phosphorylation of fructose can occur at a normal rate, even in the absence of insulin. Based on these, the work suggests that fructose (Igm/kg/day) can be recommended to diabetics.

The elevated level of cholesterol in diabetic patients, if not controlled or regulated will expose the patient to the danger of developing cardiovascular complications, stroke, coma and death may finally occur

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